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The Law's Scientific Revolution: Reflections and Ruminations on the Law's Use of Experts in Year Seven of the Revolution

David L. Faigman*

In 1993, the shot was fired that ignited the revolution over the way the law employs expert knowledge. That shot was *Daubert v. Merrell Dow Pharmaceuticals, Inc.*¹ The scientific revolution finally had reached the law. Now, seven years later, numerous battles have occurred and each side, revolutionary and counter-revolutionary alike, has variously charged the opposition, fallen back onto the ramparts, and declared victory. However, the view from the battlefield reveals an abundance of smoke and fire, numerous and ongoing skirmishes, and considerable confusion. It is clear that this revolution has yet to reach its denouement. Who shall prevail remains in considerable doubt. Thus, I offer these observations of the battle as a snapshot of a dynamic struggle whose conclusion cannot yet be discerned.

Three main camps are involved in the law's scientific revolution, and they will be my main focus of attention. First are the judges, who occupy the front-lines; it is in their ranks where the revolution will be won or lost.² The

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1. 509 U.S. 579 (1993).

2. Another camp is comprised of lawyers. Unfortunately, space does not permit a thorough examination of this very important constituency. It is a group worthy of extensive consideration. My impression is that lawyers have joined the revolution in a fairly opportunistic way. Hence, defense attorneys in civil actions have enthusiastically embraced the law's scientific reforms. Indeed, this appears to be the area in which the greatest changes have taken place. All three cases in the *Daubert* trilogy were civil actions in which the Court ultimately excluded the evidence and granted defendants' motions for summary judgment. Not surprisingly, plaintiffs' attorneys have been the most vehement opponents of *Daubert*. However, it is surprising that the criminal defense bar has not been a more fervent *Daubert* advocate because so much forensic science evidence appears to falter under close scrutiny. This could be the result of a couple of factors. First, as the text suggests, trial courts have been less than enthusiastic gatekeepers, especially in criminal cases. See *infra* notes 24-57 and accompanying text. Thus, criminal defense lawyers may have seen little profit from this course. Second, most criminal defense work is conducted by over-worked, underpaid, and under-resourced public defenders. Challenging forensic science expert testimony is a time-intensive and expensive proposition. Public defenders simply might not have the time and money to do it effectively.

second camp contains the experts themselves, who comprise most of the not-so-innocent bystanders that are either swept along or crushed by the revolution as it passes. Finally, the third group are the legal academics, who play the part of either the intelligentsia for the new order, or apologists for the old. Mariano Azuela observed, "Thinkers prepare the revolution, bandits carry it out."³ The academics should be responsible for preparing this revolution, and now the judges and lawyers must carry it out. The experts presently are caught in the whirlwind, but should join the ramparts or be removed from the field.

I. The Courts

The United States Supreme Court is responsible for starting the scientific revolution in the law and maintaining its energy over the last seven years. In 1993, Justice Blackmun wrote in *Daubert* that trial courts must be gatekeepers and are responsible for assessing the scientific validity of proffered scientific expert testimony.⁴ *Daubert* was followed by *General Electric Co. v. Joiner*.⁵ Importantly, *Joiner* was authored by Chief Justice Rehnquist,⁶ who had concurred separately in *Daubert* to express doubt about the wisdom of making judges gatekeepers.⁷ In *Joiner*, Rehnquist and the Court not only reiterated the trial court's obligations to evaluate scientific evidence, but also stressed that this obligation extended to the conclusions the expert sought to offer.⁸

The combination of an unreceptive judiciary and an over-worked criminal defense bar may have conspired to at least slow the revolution in criminal cases.

3. MARIANO AZUELA, *THE FLIES* (Lesley Byrd Simpson trans. 1918), quoted in RHODA THOMAS TRIPP, *THE INTERNATIONAL THESAURUS OF QUOTATIONS* 549 (1970).

4. See *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 597 (1993) (stating that Federal Rule of Evidence 702 assigns trial judge task of ensuring that expert testimony is reliable and relevant to task at hand).

5. 522 U.S. 136 (1997).

6. *General Elec. Co. v. Joiner*, 522 U.S. 136 (1997).

7. See *Daubert*, 509 U.S. at 600-01 (Rehnquist, C.J., concurring) (arguing that Rule 702 does not require judges to become "amateur scientists" in order to determine admissibility of expert testimony).

8. *Joiner*'s main holding, however, departed somewhat from the revolutionary character of *Daubert* and, later, *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999). The *Joiner* Court held that the standard of appellate review for admissibility determinations is abuse of discretion. *Joiner*, 522 U.S. at 141-42. In effect, this meant that appellate courts have little gatekeeping responsibilities themselves. This limited role was repeated and made more restrictive in *Kumho* itself, arguably the most revolutionary holding of the three principal cases. See *Kumho*, 526 U.S. at 152 (extending abuse of discretion standard to trial court's decision about how to determine reliability of expert testimony). In *Kumho*, the Court stated that the abuse of discretion standard extended not merely to the admissibility decision, but also to the factors employed to make that decision. *Id.* Therefore, although the Supreme Court's jurisprudence has marked out an active role for trial courts, it has not seen fit to give those courts the wisdom of appellate review.

And in *Kumho Tire Co. v. Carmichael*,⁹ the Court took its most significant step, perhaps, when it held that the gatekeeping role must be applied to all experts who seek to testify, scientist and non-scientist alike.¹⁰ Yet, despite the High Court's enthusiasm for the scientific revolution – the holdings in all three cases were unanimous, though with concurrences – lower courts appear distinctly unenthusiastic for it.¹¹ Although there are many exceptions to this statement,¹² and as time passes these exceptions grow in number, the number of exceptions continues to be too low. At every turn, it seems, numerous lower courts have sought to frustrate the *Daubert* reforms.¹³

After *Daubert*, those who did not like the idea of judges as gatekeepers argued that the opinion stressed the liberal nature of the rules and that the holding was limited to the methods and principles the expert relied upon, not the conclusions he or she asserted.¹⁴ To be sure, *Daubert* contained considerable language to support the view that more, rather than less, expert testimony

Elsewhere, I have argued that this non-revolutionary role for appellate courts is unwise and, in fact, unworkable. See generally David L. Faigman, *Appellate Review of Scientific Evidence Under Daubert and Joiner*, 48 HASTINGS L.J. 969 (1997). I will not repeat that argument here. Suffice it to say that, as a practical matter, appellate courts are likely to step into the fray when lower courts in the same circuit disagree about scientific matters that transcend individual litigation. For instance, the U.S. Court of Appeals for the Ninth Circuit is unlikely to allow one district judge to exclude handwriting identification analysis because it is generally unreliable and another to allow it because it is generally reliable. The general fact of the ability to do handwriting identification, like the general fact whether smoking causes cancer, does not change from place to place. Appellate courts are likely to frown on glaring inconsistencies within their jurisdiction, although they probably will correct these inconsistencies under cover of the abuse of discretion standard. Compare *Walker v. Soo Line R.R. Co.*, 208 F.3d 581, 588 (7th Cir. 2000) (reversing trial court's exclusion of expert testimony) with *Weisgram v. Marley Co.*, 169 F.3d 514, 522 (8th Cir. 1999) (reversing trial court's admission of expert testimony), *aff'd*, 120 S. Ct. 1011 (2000).

9. 526 U.S. 137 (1999).

10. See *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 148 (1999) (finding that *Daubert*'s gatekeeping rationale is not limited to scientific evidence).

11. See, e.g., *Daubert v. Merrell Dow Pharms., Inc.*, 43 F.3d 1311, 1315 (9th Cir. 1995) (*Daubert II*), *cert. denied*, 516 U.S. 869 (1995) ("Federal judges ruling on the admissibility of expert scientific testimony face a far more complex and daunting task in a post-*Daubert* world than before.").

12. See, e.g., *Casey v. Ohio Med. Prods.*, 877 F. Supp. 1380, 1383 (N.D. Cal. 1995) ("Armed with a degree of intellectual curiosity inherent in district court judges, and guided by two centuries of reviewing the wisdom of other occupations, federal courts will perform the assigned task.").

13. See *infra* notes 67-69 (discussing *United States v. Starzecpyzel*, 880 F. Supp. 1027 (S.D.N.Y. 1995)).

14. See, e.g., *United States v. Jones*, 107 F.3d 1147, 1158 (6th Cir. 1997) (1997) ("Such a result [that is, excluding asserted 'science' that had for a century been admitted,] truly would turn *Daubert*, a case intended to relax the admissibility requirements for expert scientific evidence, on its head.").

might be the result of the opinion.¹⁵ In particular, the Court found that the Federal Rules of Evidence did not incorporate the *Frye* test,¹⁶ which the Court deemed inherently conservative.¹⁷ Supporting this conclusion, the Court observed that a rigid "general acceptance" requirement would be at odds with the "liberal thrust" of the Federal Rules.¹⁸ Moreover, the Court stated that the trial court's responsibility was limited: "Its overarching subject is the scientific validity – and thus the evidentiary relevance and reliability – of the principles that underlie a proposed submission. The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate."¹⁹ Thus, the Court appeared to divide responsibility for evaluating scientific evidence between judge and jury, making admissibility a matter of methodology and principles and the conclusions a matter of weight to be given to the jury. Many who found an open door to expert testimony in *Daubert* emphasized these statements.²⁰

Experience soon showed, however, that *Daubert* had the effect of excluding a lot of evidence that had been admitted previously.²¹ Basic application of the *Daubert* test requires, at the very least, that judges ask experts: "What sorts of tests have you run on your hypotheses, and what do the data indicate?" Judges came to realize that many experts came from disciplines in which consensus had replaced rigorous study.²² Many of these fields have either no research, or precious little of it. Similarly, the methodology/principles distinction mentioned by Justice Blackmun never provided a useful heuristic to describe the division between the roles of judge and jury. As any scientist well understands, methodology and conclusions are not severable. The believability of the testimony (i.e., admissibility) and its persuasive import (i.e., weight) depend on both the methods used and the conclusions

15. See *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 588-89 (1993) (finding that Federal Rules of Evidence did not incorporate "general acceptance" standard of *Frye*).

16. See *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923) (stating that "in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs").

17. *Daubert*, 509 U.S. at 589.

18. *Id.* at 588.

19. *Id.* at 594-95.

20. See generally, e.g., Kenneth J. Chesebro, *Scientific Evidence After the Death of Frye: Daubert and Its Implications for Toxic Tort, Pharmaceutical, and Product Liability Cases*, 15 CARDOZO L. REV. 1745 (1994).

21. See cases cited *infra* note 70 (regarding handwriting expertise).

22. See generally *United States v. Hines*, 55 F. Supp. 2d 62 (D. Mass. 1999) (regarding handwriting experts); *Williamson v. Reynolds*, 904 F. Supp. 1529 (E.D. Okla. 1995) (regarding hair identification experts). Psychology, the main subject of the next section, has been a principal culprit of this criticism. Psychologists have too often been willing to reach politically preferred conclusions that are too often supported by little or no research.

sought to be drawn from that research. In *Joiner*, the Court largely rejected the methodology and principles distinction, emphasizing that the trial court must ensure that the expert's conclusion reasonably follows from the methodology and principles that underlie it: "[N]othing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert."²³

After *Joiner*, however, lower courts continued to bridle against the gatekeeping role.²⁴ This reluctance to conduct substantive evaluations of expert testimony manifested itself most ardently in courts that found *Daubert* did not apply to so-called non-scientific expert testimony.²⁵ This claimed exception turned out to pose a substantial threat to the entire Rule 702 framework. Scientific evidence that failed the rigorous dictates of *Daubert* could reinvent itself as technical or other specialized knowledge and still appear before the trier of fact.²⁶ But the *Kumho* Court recognized this ruse for what it was and held that the gatekeeping role extended to all expert testimony.²⁷

Since *Daubert*, the Supreme Court steadily has insisted that expert testimony be based on reliable methods and that trial courts have the responsibility to conduct this assessment.²⁸ Just recently, in *Weisgram v. Marley Co.*,²⁹ the Court stated unequivocally the critical perspective that undergirds *Daubert*.³⁰ *Weisgram* examined whether an appellate court has the authority to order judgment as a matter of law after finding that the trial court abused its discretion in admitting plaintiff's expert testimony.³¹ In *Weisgram*, the Court considered whether the plaintiff should be afforded the opportunity to retry the case with a different set of experts.³² The Court, with Justice Ginsburg writing, rejected this argument, stating that plaintiffs should not be given two bites at the apple if their experts later are found to fail the *Daubert* test on appeal:

23. General Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997).

24. See generally, e.g., Carmichael v. Samyang Tire Co., 131 F.3d 1433 (11th Cir. 1997), rev'd, Kumho Tire Co. v. Carmichael, 526 U.S. 137 (1999).

25. *Id.* at 1436.

26. See *infra* notes 67-69 and accompanying text (discussing *United States v. Starzecpyzel*, 880 F. Supp. 1027 (S.D.N.Y. 1995)).

27. See *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 148 (1999) (finding that *Daubert*'s gatekeeping rationale is not limited to scientific knowledge).

28. *Id.* at 147-49; General Elec. Co. v. Joiner, 522 U.S. 136, 142 (1997).

29. 120 S. Ct. 1011 (2000).

30. See *Weisgram v. Marley Co.*, 120 S. Ct. 1011, 1021 (2000) (noting that *Daubert* discourages parties from failing to put on "their best expert evidence in the expectation of a second chance").

31. *Id.* at 1015.

32. *Id.* at 1016.

Since *Daubert*, . . . parties relying on expert evidence have had notice of the exacting standards of reliability such evidence must meet. It is implausible to suggest, post-*Daubert*, that parties will initially present less than their best expert evidence in the expectation of a second chance should their first try fail. We therefore find unconvincing [the plaintiff's] fears that allowing courts of appeals to direct the entry of judgment for defendants will punish plaintiffs who could have shored up their cases by other means had they known their expert testimony would be found inadmissible.³³

Not surprisingly, many lower courts continue to resist.³⁴ Some simply ignore their responsibility, paying no more than lip-service to their obligations and offering conclusory statements that the evidence is reliable³⁵ or that the expert has sufficient experience with the subject.³⁶ This tactic appears especially attractive to courts confronting purely experiential-based testimony, such as prosecutorial use of law enforcement officers who testify on whether the drugs found were likely to be possessed with an intent to distribute,³⁷ or on the organizational structure of gangs or organized crime.³⁸ Another trend just emerging among some courts is to quote and rely on a passage in *Kumho*³⁹ that suggests that the inquiry concerns whether the expert "employ[ed] in the courtroom the same level of intellectual rigor that characterizes the practice

33. *Id.* at 1021 (citations omitted).

34. See 1 DAVID L. FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY § 1-3.4.1, at 15-17 (1997 & Supp. 2000) (discussing lower courts' continued resistance to gatekeeping role).

35. See, e.g., *Benjamin v. Kerik*, No. 75 CIV. 3073 HB., 2000 WL 278085, at *1 (S.D.N.Y. Mar. 14, 2000) (finding expert testimony met reliability requirements of Rule 702, but failing to explain how such requirements were met).

36. See, e.g., *Sullivan v. Ford Motor Co.*, No. 97 CIV 0593 (RCC), 2000 WL 343777, at *5 (S.D.N.Y. March 31, 2000) (allowing testimony of safety engineer based on experience of investigating approximately 15,000 road accidents and preparing approximately 10,000 reports based on these investigations). The court did not reflect on the fact that for the expert to have investigated 15,000 accidents, he must have visited approximately 1.5 accident scenes everyday for 30 years.

37. See, e.g., *United States v. Harris*, 192 F.3d 580, 589 (6th Cir. 1999) (finding district court did not abuse its discretion in allowing officer to testify regarding usual methods of drug traffickers).

38. See, e.g., *United States v. Hankey*, 203 F.3d 1160, 1169 (9th Cir. 2000) (finding that extensive voir dire of expert witness by district court was sufficient to assess relevance and reliability of witness's testimony); *United States v. Tocco*, 200 F.3d 401, 419 (6th Cir. 2000) (finding that expert witness testimony regarding "inner-workings of organized crime" is both relevant and reliable under *Daubert*).

39. See *Bryant v. City of Chicago*, 200 F.3d 1092, 1098 (7th Cir. 2000) (allowing expert who had brought same intellectual rigor to courtroom, despite not meeting any *Daubert* factors); *Skidmore v. Precision Printing & Packaging, Inc.*, 188 F.3d 606, 618 (5th Cir. 1999) (same).

of an expert in the relevant field."⁴⁰ For some courts, unfortunately, this standard has become *the* test.⁴¹

The problem with the same intellectual rigor test is obvious. It is, in effect, a restatement of the general acceptance prong of *Daubert*, taken from the language of *Frye*. It suffers all of the problems associated with the worst abuses of that test.⁴² Specifically, if the field is bankrupt of data or not especially rigorous in its testing of hypotheses, courts will not get very reliable opinion testimony. The *Daubert* query is not simply whether the expert is using the same intellectual rigor in court that he or she would use in the field. *Daubert* asks whether the expert testimony itself is based on a sufficiently rigorous research foundation.⁴³ Surely, if an expert fails to use the same intellectual rigor used in the field, he or she should be excluded. But an expert's use of the same intellectual rigor in the courtroom as in the field does not ensure reliable testimony if the field itself is not rigorous. The same intellectual rigor test is a necessary, but not a sufficient, criterion for admission. From astrology to certain forensic and psychological opinion, courts will not be receiving good evidence if they merely rely on the intellectual rigor accepted in the field. Simply put, many fields of expertise lack intellectual rigor, and courts must recognize when this is so. The whole point of *Daubert* was to require courts to assess the fields themselves and not defer to the guilds that bring their so-called expertise to the courtroom.⁴⁴

Lower courts' reluctance to embrace *Daubert* appears to be attributable to three concerns on their part. First, courts have been surprised and chagrined at the seeming outcomes of a faithful application of the *Daubert* test to all expert testimony.⁴⁵ A lot of previously admitted evidence, especially evidence offered by prosecutors, appears excludable for want of a research base.⁴⁶ A second consideration is that judges and lawyers find themselves inadequately trained in the scientific method.⁴⁷ Although few would assert that judges need to become amateur scientists, the gatekeeping role expects

40. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 152 (1999).

41. See cases cited *supra* note 39.

42. See *supra* notes 16-19 and accompanying text.

43. See *Weisgram v. Marley Co.*, 120 S. Ct. 1011, 1021 (2000) ("Since *Daubert* . . . parties relying on expert evidence have had notice of the exacting standards of reliability such evidence must meet.").

44. See *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 589 (1993) (stating that "trial judge must ensure that any and all scientific testimony is not only relevant, but reliable").

45. See *infra* notes 66-70 and accompanying text.

46. See *infra* notes 66-70 and accompanying text.

47. See DAVID L. FAIGMAN, *LEGAL ALCHEMY: THE USE AND MISUSE OF SCIENCE IN THE LAW* 53-54 (1999) (noting "legal consumers of scientific research often have little understanding of the product they are buying").

judges to have at least enough knowledge to evaluate a program of research.⁴⁸ This is a daunting task for judges with little background in the scientific method and statistics. Courts' third concern, which is closely related to the second, is the seeming enormity of the task and, frankly, the intellectual difficulty involved in integrating the scientific culture into the law.⁴⁹

The fact that many kinds of previously admitted expertise stumble under *Daubert* scrutiny is a peculiar source of judicial concern.⁵⁰ One might even expect a judicial outcry against the sloppy way that prosecutors have gone about verifying the expert evidence upon which they so often rely. In any case, the lack of data is a defect that can be remedied readily. Many of the forensic sciences that now are bereft of data, from arson investigation to firearms identification, could be tested readily with relatively minimal effort.⁵¹ The primary reason they have not yet tested their expertise is that courts have not required them to do so. For instance, if courts begin uniformly to exclude handwriting identification analysis, the research almost certainly will be done. Law enforcement agencies have too much to lose not to invest in this research. In fact, this is an unexpected windfall of *Daubert*: Fields that, until now, have relied on the limited tools of observation and experience will begin to test more rigorously their hypotheses and their proficiency to do what they claim they can do.

The second matter, lack of scientific sophistication, also should trouble trial courts less than it does. Understandably, judges feel unable to devote the time necessary to learn the basics of science. Judges typically are very busy people, and becoming well-versed in the scientific method takes time and substantial effort. Moreover, though they are less likely to admit this fear, the risk of embarrassment is not insubstantial in this domain. No one wants to confuse a slope and an intercept when describing a regression line.⁵² But, increasingly, there are a surfeit of state and federal programs dedicated to assisting judges learn the science.⁵³ There are also treatises that offer guidance specifically directed at a legal audience.⁵⁴ And perhaps most helpfully,

48. See Stephen Breyer, *Introduction* to REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 2 (2d ed. 2000) ("Our decisions should reflect a proper scientific and technical understanding so that the law can respond to the needs of the public.").

49. See FAIGMAN, *supra* note 47, at 190-204 (discussing process of integrating scientific information into policy formation).

50. See *supra* notes 21-23 and accompanying text.

51. See 1 FAIGMAN ET AL., *supra* note 34, § 20-5.0, at 12-17 (discussing application of scientific method to forensic science).

52. See 1 *id.* § 3-5.3.1, at 134 (explaining these terms and their relevance to regression analysis).

53. Examples include week-long programs by the National Judicial College in Reno, Nevada, and one and two day programs organized by the Federal Judicial Center.

54. See generally FAIGMAN ET AL., *supra* note 34; PAUL C. GIANNELLI & EDWARD J. IMWINKELRIED, SCIENTIFIC EVIDENCE (3d ed. 1999); REFERENCE MANUAL ON SCIENTIFIC EVIDENCE (2d ed. 2000).

judges can receive assistance from court-appointed experts. Indeed, there are several organizations with programs designed to identify neutral (i.e., unaffiliated) experts for this purpose.⁵⁵ Having an expert from the field to discuss the complexities of the science greatly should improve judges' comprehension of the research and relieve their fears of making a holding or writing an opinion that delves deeply into the subject.

The third concern, the question of integrating the scientific culture into the law, is not without its difficulties and is likely to prove to be the most demanding challenge to the law and science connection over time. I have considered this subject elsewhere in book-length form.⁵⁶ Suffice it to say here that judges and lawyers must remember that they are using science ultimately for their own institutional purposes.⁵⁷ Law and science do not have an identity of interests nor do they share objectives. Science is a supremely useful means for investigating the facts of the world. But more often than not, and almost invariably in the area of applied science (of the sort the law cares about), facts are known with more or less confidence. Lawmakers ultimately must decide how much confidence they need in a fact before making a decision. This is not to say that law can be lazy about its understanding of science because so much of the equation involves policy judgments. Indeed, just the opposite is true. Law must fully appreciate what the scientific method has to offer. It is not possible to make sound science policy without a competent understanding of both policy *and* science. The law must decide how insistent it should be that the science be done and what it should expect from experts who claim special knowledge of the real-world.

II. The Experts

At a conference that the American Psychological Association and the American Bar Association organized in October 1999, I attended a panel discussion that included, among other notable panelists, Justice Stephen Breyer. It was a fairly interesting panel, though the panelists tended to avoid the more salient and more controversial issues that now confront the relationship between science and the law. The conference organizers asked Justice Breyer

55. Two programs, in particular, are worth mentioning. The American Association for the Advancement of Science (AAAS) has just recently begun to compile lists of scientists who might be available to courts. See generally *Court Appointed Scientific Experts: A Demonstration Project of the AAAS*, at <http://www.aaas.org/spp/case/case.htm> (last visited Sept. 15, 2000) (copy on file with Washington and Lee Law Review). A similar program has been put together by the Private Adjudication Center at Duke University. See generally *The Registry of Independent Scientific and Technical Advisors: A Program of the Private Adjudication Center Duke University School of Law*, at <http://www.law.duke.edu/pac/registry/index.html> (last visited Sept. 15, 2000) (copy on file with Washington and Lee Law Review).

56. See generally FAIGMAN, *supra* note 47.

57. See *id.* at 56-57 (discussing institutions of law and science and their mutual interests and jealousies).

to be on the panel because he authored the Court's opinion in *Kumho*. Hence, a key component of the panel's discussion inevitably concerned the effect *Kumho* would have on experts who specialize in the psychological sciences. I want to give some attention to this matter because I have given it a fair amount of thought.⁵⁸ My main objective in this section, however, is to respond to a related issue which came by way of a question that Justice Breyer directed to the audience. The audience was composed primarily of psychologists. He asked at one point: What is good psychology, and how can courts recognize it? The problem of defining successful scientific fields, successful history, or successful accounting turns out to be a rather important matter, and the success of the *Daubert* trilogy depends on the answer. Yet, no one rose to the challenge of offering an answer at that time. I am sorry that I did not, but I would like to redress that failure here. Although the points made below apply equally to a host of other fields, I will use psychology to consider this issue because it was the subject of Justice Breyer's query.

My short answer to Justice Breyer's question is that psychology is good when it employs the critical and rigorous methods of science to test hypotheses, including hypotheses regarding psychologists' abilities to make forensic assessments. The second, albeit related, part of Breyer's question involves telling courts how they can recognize good science when they see it. But science is not recognizable in the sense that anyone could offer a recipe for how it is done. Like Justice Stewart's observation regarding obscenity, we know it when we see it.⁵⁹ But this is not very helpful because it gives little direction or guidance. Thomas Huxley observed that: "Science is nothing but trained and organized common sense" ⁶⁰ Huxley, however, understood well the very high levels of training and organization necessary to turn common sense into science. Teaching the scientific method to judges who have no training in, or understanding of, the scientific culture is like trying to explain proximate cause to someone who has not gone to law school. The concept of proximate cause is embedded in the legal culture and is not easily disentangled from it. Understanding the scientific method requires knowing the culture of science.

In answering Justice Breyer's question, then, it is necessary to consider the scientific culture because it is, or should be, the foundation of the psychological expertise that comes to the courts. This matter cannot be approached without contemplating the nature of knowledge itself and alternatives to

58. See generally David L. Faigman, *The Evidentiary Status of Social Science Under Daubert: Is It "Scientific," "Technical," or "Other" Knowledge?*, 1 PSYCHOL. PUB. POL'Y. & L. 960 (1995); David L. Faigman, *To Have and Have Not: Assessing the Value of Social Science to the Law as Science and Policy*, 38 EMORY L.J. 1005 (1989).

59. *Jacobellis v. Ohio*, 378 U.S. 184, 197 (1964) (Stewart, J., concurring).

60. A DICTIONARY OF SCIENTIFIC QUOTATIONS 126 (Alan L. Mackay ed., 1991) (quoting Thomas Henry Huxley, *The Method of Zedig*, in COLLECTED ESSAYS IV (1894)).

scientific knowledge. The Federal Rules divide expert knowledge into categories of scientific, technical, or other specialized knowledge.⁶¹ These are all parts of what might be termed empirical knowledge, or knowledge of the real world. But the Rules contain an unstated duality, for missing in them is what might be called non-empirical knowledge or values. The Rules of Evidence, therefore, divide the world into two basic categories, empirical knowledge and non-empirical knowledge, with science being one sort of empirical knowledge. Expert testimony is limited to opinions about the empirical world that are based on good grounds. That non-empirical knowledge is not within the purview of an expert is hardly a shocking statement because the expert is in court to assist the trier of fact, not to make policy. Thus, the definition of empirical knowledge under the Rules, and whether psychology sometimes qualifies, must take into account its opposite, norms or values.

In some sense, all of human existence is dual in nature. Dark is defined by light, white by black, up by down, good by evil, and empirical science by normative values. An ancient Buddhist observation illustrates this point:

The nonverbal, concrete world contains no classes and no symbols which signify or mean anything other than themselves. Consequently it contains no duality. For duality arises only when we classify, when we sort our experiences into mental boxes, since a box is no box without an inside and an outside.⁶²

Life would be simple if these dualities were merely categorical. But we know this to be untrue because dark dawns into light, white grays into black, and science embeds and informs values. Justice Breyer's question, therefore, is not so simple. Indeed, the general subject has occupied philosophers ever since the dark ages brightened into the Enlightenment. Hence, though I have no pretensions of being able to answer the question definitively, it is a question worthy of sustained attention.

The *Daubert* trilogy is about drawing the line between valid empirical knowledge and value-driven empirical speculation. Sometimes, the values driving the speculation are pecuniary gain, and at other times politically preferred legal outcomes. Obviously, testimony bought for \$1000 per day is an affront to the expert's designated role, but no less obnoxious is testimony that is the product of an overweening conscience. Whatever the motivation, then, *Daubert* instituted the judge as gatekeeper in order to block such speculation from the courtroom.⁶³

61. FED. R. EVID. 702.

62. ALAN W. WATTS, *THE WAY OF ZEN* 73 (1957).

63. See *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 597 (1993) (stating that Federal Rule of Evidence 702 assigns trial judge task of ensuring that expert testimony is reliable and relevant to task at hand).

The line between science and speculation is, at best, indistinct. The line drawing problem is marked especially in the law because most evidence codes allow experts to testify to more than just scientific knowledge. This was the subject of *Kumho*.⁶⁴ In *Kumho*, as noted above, the Court considered whether the gatekeeping role articulated in *Daubert* applied to non-scientific evidence or, in the language of the Federal Rules of Evidence, technical or other specialized knowledge.⁶⁵ After *Daubert* was decided, a lot of formerly proud-to-be-sciences came very quickly to describe themselves as specialties in order to avoid the apparently rigorous dictates of the *Daubert* test. Particularly good examples of this were the handwriting identification specialists, formerly members of the proud forensic sciences. Amazingly, it actually *worked* in several cases. In *United States v. Starzecpyzel*,⁶⁶ for instance, Judge McKenna concluded that if handwriting identification were a science it would not be admitted under *Daubert*.⁶⁷ However, because they were specialists, they could testify.⁶⁸ *Kumho* closed this loophole.⁶⁹ And since *Kumho* was decided, three federal courts have prohibited handwriting identification experts from testifying to authorship because they have failed so far to collect the data that would validate their ability to do this.⁷⁰

Psychology might present similar issues. I gave a presentation on *Daubert* at the August 1993 annual meeting of the American Psychology Association, which was shortly after *Daubert* had been decided. I blithely assumed that *Daubert* was applicable to psychology and considered it a warning shot across the field's bow. Immediately after the talk, a gentleman came up to me and said that he did not think *Daubert* applied to his profession because he was a clinician and thus qualified as a specialist under the Rules of Evidence. I realized then that *Daubert* had a back door through which all sorts of experts might crawl, having been turned away at the front door of scientific knowledge. *Kumho*, as noted, closed this particular back door.⁷¹

64. See *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 146 (1999) (considering whether trial court may utilize *Daubert* factors in determining admissibility of engineering expert's testimony).

65. *Id.*

66. 880 F. Supp. 1027 (S.D.N.Y. 1995).

67. *United States v. Starzecpyzel*, 880 F. Supp. 1027, 1036 (S.D.N.Y. 1995).

68. *Id.* at 1047.

69. See *Kumho*, 526 U.S. at 152 (requiring reliability assessment be done for all expert testimony).

70. See generally *United States v. Santillan, Nc.* CR-96-40169, 1999 WL 1201765 (N.D. Cal. 1999); *United States v. Hines*, 55 F. Supp. 2d 62 (D. Mass. 1999); Transcript of Pretrial Hearing on *Daubert Issues*, *United States v. McVeigh*, No. 96-CR-68, 1997 WL 47724 (D. Colo. Feb. 5, 1997).

71. See *supra* notes 66-69 and accompanying text.

But many windows remain through which bad science might yet seek entry into the citadel – including bad psychological science.

Kumho forces us to look hard at what experts do, both as scientists and as specialists. In short, *Kumho* asks us to reflect on how we know what we think we know. This, of course, is the essence of the scientific method. Science, contrary to what some courts think, is not an item to be described, detailed, or defined. It is a path to knowledge, not knowledge itself. Hence, when the Federal Rules of Evidence speak of scientific, technical, or other specialized knowledge, they are talking about approaches that might be taken to gain knowledge and the expert opinion that is based on that knowledge. Science, especially applied science, tends to know the world with a good deal of uncertainty attached to that knowledge. We know whether the Georgia death penalty scheme discriminates on the basis of the race of the victim only with more or less confidence.⁷² We know that people have difficulty with eyewitness identifications when there is a weapon present only with more or less confidence.⁷³ Finally, we know that a sexual offender is likely to be violent again in the future only with more or less confidence.⁷⁴ Whether we act on that knowledge and how we act on it is a policy choice, hopefully flowing from a careful calculation of the costs of making an error, whether of the false positive or false negative variety.

The key to being a good scientist is, of course, to be self-critical. Thus, Karl Popper and the Court in *Daubert* used the notion of falsification to describe the process of hypothesis testing.⁷⁵ The underlying point is that only when hypotheses survive myriad attempts to falsify them do we gain enough confidence to believe them. Hence, if we believe that cross-racial identifications are less reliable than same-race identifications, research should rigorously test this hypothesis by subjecting it to tests that would falsify it. The logic of the null hypothesis is that we should not accept our pet hypothesis – the alternative hypothesis – until we have no choice based on our rules of decision. Konrad Lorenz advised that: "It is a good morning exercise for a research scientist to discard a pet hypothesis everyday before break-

72. See discussion *infra* notes 85-92 and accompanying text.

73. See generally Thomas H. Kramer et al., *Weapon Focus, Arousal, and Eyewitness Memory*, 14 LAW & HUM. BEHAV. 167 (1990) (discussing phenomenon of "weapon focus," whereby witness to crime concentrates on criminal's weapon rather than other details of crime); Elizabeth F. Loftus et al., *Some Facts About Weapon Focus*, 11 LAW & HUM. BEHAV. 55 (1987) (same).

74. See generally Marnie E. Rice & Grant T. Harris, *The Scientific Status of Research on Sexual Aggressors*, in 3 MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY § 36-2.0 (David L. Faigman et al. eds., 1999) (discussing recidivism among sexual aggressors).

75. *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 593 (1993) (discussing falsifiability as criterion of test).

fast."⁷⁶ Yet, in study after study, researchers almost invariably conclude with suggestions for policy reform based on relatively scanty data. Moreover, whether policy should change because the data point in one direction is, in the ordinary case, not at all obvious.

Not only must psychologists be self-critical, but psychology, as a field, needs to critically appraise itself. Researchers should be out there trying to falsify one another's pet hypotheses. When researchers at the University of Utah announced cold fusion, laboratories around the country immediately went to work trying to test it.⁷⁷ Admittedly, cold fusion lent itself better to testing than many psychological hypotheses, but the attitude is most important. Possibly because psychologists, especially psychologists who do work that is applicable to the law, are interested in socially and politically divisive issues, going against the grain is difficult and, indeed, potentially perilous. In short, many researchers do not conduct rigorous testing or evaluate the testing that they and others conduct because they are concerned about being politically incorrect. This phenomenon is not unlike what early scientists in the sixteenth and seventeenth centuries must have experienced with the censorship that accompanied findings and inventions that contravened church doctrine.⁷⁸ In our time, the rape trauma syndrome, the battered woman syndrome, repressed memories, post-traumatic stress disorder, and child abuse accommodation syndrome all represent accession to holy writ.

There is no simple solution to this problem, though I think that if experts realize that their politically correct science sometimes can be used for politically incorrect outcomes, then they will, at least, take a more sober view of what they are doing. If children are competent enough to participate in the decision whether to be institutionalized in a mental hospital, are they competent enough to be tried as adults and possibly suffer capital punishment? More and more, the biggest consumers of the battered woman syndrome over the last several years are prosecutors who are using it to elude the character evidence rules in their prosecutions of alleged batterers.⁷⁹ Even more politically incorrect, prosecutors increasingly are seeking to subject women-defendants who claim to be suffering from the battered woman syndrome and post-traumatic stress disorder to state psychiatric examinations.⁸⁰ Finally, researcher-

76. THE OXFORD DICTIONARY OF QUOTATIONS 428 (Angela Partington ed., 4th ed. 1992) (quoting KONRAD LORENZ, ON AGGRESSION (1966)).

77. See generally GARY TAUBES, BAD SCIENCE: THE SHORT LIFE AND WEIRD TIMES OF COLD FUSION (1993) (discussing cold fusion research).

78. See FAIGMAN, *supra* note 47, at 14-18 (discussing trial of Galileo).

79. See David L. Faigman & Amy J. Wright, *The Battered Woman Syndrome in the Age of Science*, 39 ARIZ. L. REV. 67, 96-99 (1997) (discussing issues concerning prosecutorial use of battered woman syndrome).

80. See, e.g., *State v. Hickson*, 630 So. 2d 172, 176 (Fla. 1993) (concluding that woman

advocates in this area claim that the battered woman syndrome is associated with or functionally equivalent to post-traumatic stress disorder.⁸¹ However, this move totally ignores the underlying realities of the legal defenses these psychological constructs were meant to serve. The battered woman syndrome is directed to classic self-defense, which is based on justification. Post-traumatic stress disorder is directed at excuse based defenses. It would not be surprising to see some zealous prosecutor one day seek to civilly commit a woman who is acquitted on the basis that she suffered from a combination of battered woman syndrome and post-traumatic stress disorder. And in the area of the rape trauma syndrome, defendants increasingly are seeking to use this evidence, a move that deeply threatens the reforms of the 1970s that led to enactment of rape shield statutes across the country.⁸²

Psychologists in this area too often measure their success by how much impact their research has on specific cases or on the development of the law. This is wrong on at least two levels. First of all, it is wrong if, as scientists, they have a political agenda that they set out to achieve by conducting research that gives them the facts to support their opinions. Indeed, this is probably exactly the opposite of what research agendas are supposed to be about. I think this happens more often than it should, but the obviousness of the problem is clear enough that I need not dwell on it. But, let me just say that, as a profession, psychology ought to stand up and state clearly that political agendas masquerading as science are not acceptable. Practical politics is fundamentally inconsistent with science. As Henry Adams remarked: "Practical politics consists in ignoring facts."⁸³

The second reason it is wrong is somewhat less obvious. It is wrong because when psychologists measure their success by immediate results, measured by number of citations by courts, they fail to do the research that is necessary to have a lasting impact on the legal profession. Take, for instance, the area of mental competency of children. A lot of the research in this area uses legal constructs of competency as the operational definitions for the work.⁸⁴ One of the results of this framework is that little attention is paid to

who raises battered woman syndrome as defense may waive her right to refuse to submit to examination by state's expert).

81. See Lenore A. Walker, *Post-Traumatic Stress Disorder in Women: Diagnosis and Treatment of Battered Woman Syndrome*, 28 *PSYCHOTHERAPY* 21, 22 (1991) (comparing battered woman syndrome to post-traumatic stress disorder).

82. See 1 FAIGMAN ET AL., *supra* note 34, § 10-1.5, at 412 (discussing defense use of rape trauma syndrome).

83. THE OXFORD DICTIONARY OF QUOTATIONS 2 (Angela Partington ed., 4th ed. 1992) (quoting HENRY ADAMS, *THE EDUCATION OF HENRY ADAMS* (1907)).

84. See generally, e.g., THOMAS GRISSO, *JUVENILES' WAIVER OF RIGHTS: LEGAL AND PSYCHOLOGICAL COMPETENCE* (1981).

the broader psychological considerations that might be considered and that might allow generalizations to be made across legal contexts. This also limits the value of the research if the legal formulations should change. Rather than relying on *legal* conceptions of mental competency, psychologists should be doing more to convince courts of the value of psychological conceptions of competency. This might mean that their research seemingly will be ignored for a time because courts might be disinclined to adopt alternative conceptions of mental competency than what precedent directs. But, over time, psychologists would have much greater influence on the law by conducting psychologically sound research than with the current approach, which appears to be little more than a fixation on winning some immediate cases before the courts.

When psychologists focus on whether courts and legislatures adopt their pet hypotheses, they select the wrong outcome variable to measure their success. Consider, for example, the research conducted by David Baldus and his colleagues that indicated that the Georgia capital sentencing scheme discriminated on the basis of the race of the victim.⁸⁵ Those convicted of killing whites were 4.3 times more likely to get the death penalty than those who killed blacks.⁸⁶ Many saw the Baldus study as a failure because the Supreme Court seemingly ignored it in *McCleskey v. Kemp*.⁸⁷ In *McCleskey*, the Court concluded that discrimination on the basis of the race of the victim did not violate either the Eighth or Fourteenth Amendments, unless the petitioner could show individualized discrimination.⁸⁸ But the Baldus study, the Court explained, merely indicated a discrepancy that appears to correlate with race.⁸⁹ The Court further pointed out that "[e]ven Professor Baldus does not contend that his statistics prove that race enters into any capital sentencing decisions or that race was a factor in McCleskey's particular case."⁹⁰ The Court thus concluded that the research was largely irrelevant to the constitutional question presented.⁹¹

In fact, however, the Baldus study was a great success. It forced the Court to face the realities of this discrimination, when the Court clearly would have preferred to say that there was no evidence of discrimination. Because the

85. See DAVID C. BALDUS ET AL., EQUAL JUSTICE AND THE DEATH PENALTY 312-69 (1990) (discussing research on Georgia capital sentencing scheme).

86. *Id.* at 344.

87. 481 U.S. 279 (1987).

88. See *McCleskey v. Kemp*, 481 U.S. 279, 292, 308 (1987) (concluding that sentence did not violate Eighth or Fourteenth Amendments).

89. See *id.* at 312 ("[T]he Baldus study indicates a discrepancy that appears to correlate with race.").

90. *Id.* at 308.

91. See *id.* at 313 (holding that Baldus study does not demonstrate constitutionally significant risk of racial bias in Georgia's capital sentencing process).

study indicated systemic disparities based on race, the Court suffered a blow to its legitimacy in not coming to grips with the realities of this discrimination. The research prompted legislatures and conscientious prosecutors to review the matter. It also sparked numerous law review articles.⁹² Finally, and I see it every year when I teach the case to my Science and Law class, the research influences how students understand the case and how they see the Court.

It is both myopic and ironic that so many psychologists measure the success of legally relevant psychological science on whether courts cite it. It is myopic because the legal system is far broader than court opinions and science's value has to be larger than what the current generation of jurists recognizes. It is ironic because most psychologists, as is true for most scientists, have little respect for the empirical acumen of the average judge, yet they are thrilled when judges write of the value and validity of their research.

So, is it possible for scientists to offer policy prescriptions for the law? This, of course, is the multi-million-dollar question.⁹³ Moreover, it is not a question that is limited, by any means, to the psychological sciences. A recent issue of *Science* devoted substantial space to this very issue as it concerned ecologists.⁹⁴ Among ecologists, a growing number are, as the story put it, sticking their necks out to inform policy makers about not only their data, but what should be done with their data.⁹⁵ Other ecologists fear that this practice confuses them with environmental activists.⁹⁶ This confusion is thought to lead to a discounting of their statements regarding the science because those statements are perceived as being suffused with opinion.⁹⁷ Others take a very different view. As Stuart Pimm argued, "I have a moral responsibility as a citizen to make people aware of what the science means."⁹⁸ The danger, of course, is that when the science does not support scientist-advocates' policy views, they might be inclined to discount or ignore it.⁹⁹ Hence, if it turns out that biodiversity is not healthier to all ecosystems, an ecologist devoted to biodiversity will fear recognizing this research because it might fuel his or her political enemies' arguments against conservation.¹⁰⁰

92. See generally, e.g., Randall L. Kennedy, *McCleskey v. Kemp: Race, Capital Punishment, and the Supreme Court*, 101 HARV. L. REV. 1388 (1988) (criticizing Court's decision in *McCleskey* and analyzing equal protection aspect of case).

93. It used to be the \$64,000 question, but times have changed.

94. Jocelyn Kaiser, *Ecologists on a Mission to Save the World*, 287 SCIENCE 1188 (2000).

95. *Id.* at 1188.

96. *Id.*

97. *Id.*

98. *Id.*

99. *Id.* at 1191.

100. *Id.* at 1190-91.

The psychological sciences, of course, are well along the path to being considered little more than handmaidens for particular political points of view. This is unfortunate and perhaps will not soon change. But psychologists should seek to change it, both for the sake of their science and for the sake of the law. Scientists serve neither themselves nor the law well if they are nothing more than mere technicians for lawyers' views of psychology or, worse yet, advocates for their own views that they peddle as the latest scientific discovery. Today, psychology's value to the law is fairly broad but not very deep. In most areas, psychology is little more than one of many interest groups trying to get its policies enacted through legislation or court decision. As a profession, psychology should take a broader view of its relevance and a more humble view of its ability to supply answers to short-term discrete questions.

Psychologists should hesitate before seeking to bring their findings to policymakers, fearful that when tested the research might be thought not-yet-done. Again, consider the example of the battered woman syndrome, a psychological construct with unparalleled success in the law. In 1985, which would have been thought more likely? That by the year 2000 we would have mapped virtually the entire human genome, or that we would know what percentage of women in violent relationships are in constant fear and how that fear is tied to the so-called cycle theory of violence? Psychologists' research sometimes seems designed more to get them on the witness stand than to understand the phenomenon that they are studying.

I do not mean to reject entirely the post-modern insight that objectivity in science cannot be wholly achieved. Without question, scientists' attitudes and their politics affect the hypotheses they generate and the studies they design to test them. But this insight should not lead them to abandon pursuit of scientific objectivity; it should lead them to seek it with greater ardor. From double-blind methods to replication, the scientific method should root out prejudice, bias, and preconception. Claude Bernard, writing in 1865, said: "[E]xperiments must always be devised in view of a preconceived idea, no matter if the idea be not very clear nor very well defined. As for noting the results of the experiment, . . . we must here, as always, observe without a preconceived idea."¹⁰¹ Too much research in law and psychology is driven by the ends of legal policy. This approach, although maybe effective in the short term – and maybe not – is doomed to the trash heap of yesterday's politics.

What, then, should be the objectives of psychologists who conduct legally relevant research? While individual research goals necessarily will vary within the field, the goal should not be to accomplish specific short term

101. CLAUDE BERNARD, *AN INTRODUCTION TO THE STUDY OF EXPERIMENTAL MEDICINE* 23 (Henry Copley Greene trans., Dover Publications ed. 1957) (1865).

objectives or to measure success by the number of legal citations garnered. The law, through cases like *Daubert* and its progeny, has begun the long trek toward scientific sophistication. It would be unfortunate, indeed, if psychology should prove unworthy of this more sophisticated scrutiny.

Law and science are separate institutions and they bring different objectives to the law and science connection. The law should seek the integration of scientific knowledge into its decision making. But it is the law's paradigm that is incorporating science, ultimately for its own institutional purposes. Psychology should seek to develop and test hypotheses concerning human behavior, some of which will be helpful to the law. Psychology's institutional interests are different than the law's. For psychology, the triumph lies in explaining human behavior, not in the sale of their explanations to lawyers and judges. Just because they can sell "The Battered Woman Syndrome" to judges and legislators does not mean that it is true. Furthermore, just because they cannot sell the realities of the unreliability of predictions of violence does not mean that the phenomenon is false.

Those psychologists who specialize in the law must decide individually whether they are attorney-psychologists or psychologist-attorneys. It is not possible to be both. Science and the law play by wholly different sets of rules. Yet, they play on the same fields, and therefore they have to decide by which set of rules they will abide. The law is, at bottom, a normative institution. It is also practical and pragmatic, but its success is measured by values and morals. The law is a consumer of information with the purpose of producing fair, just, equitable, and efficient outcomes. Psychology is a producer of information. It ought to transcend practical politics, seeking information that transcends legal contexts and, if possible, social contexts. When producers become consumers, they inevitably prefer their own product over all others. And the products themselves will be tailored to the producers' consumption preferences. A scientist who measures his or her success by the rules of the law is no longer a scientist.

What this all means, then, is that the law decides how and whether to use psychology. The law needs to be a sophisticated consumer of science. This, in fact, is the principal lesson of the *Daubert* trilogy. Scientists certainly can and should criticize the law for not using science well. But this is not the same thing as saying that scientists should criticize the law for failing to use science to some particular end.

For example, the Supreme Court did not employ science well in *Lockhart v. McCree*,¹⁰² in which the issue was whether excluding certain jurors would result in prosecution-prone juries.¹⁰³ But proving this criticism does not

102. 476 U.S. 162 (1986).

103. See *Lockhart v. McCree*, 476 U.S. 162, 165 (1986) (stating issue of case).

support the opposite conclusion, that the Court should have rested its decision on the research. The law is allowed to decide that the empirical question has become irrelevant or of little significance. In 1973, the Court chose viability as the point at which the government could prohibit abortions, except in cases where it was necessary to save the life of the mother.¹⁰⁴ At that time, viability, a medical fact regarding the time when a fetus can survive outside of the womb, was approximately at the end of the second trimester. Clearly, this was a convenient fact for establishing a compromise between the woman's right of reproductive choice and the government's interest in the potential life of the fetus. If medical technology were to move viability to the sixth week of pregnancy, no one seriously would expect the Court to continue to employ this fact. The Court could be criticized for using viability at all, or for its relatively poor understanding of the medical technology upon which it relied. But the science simply does not give the scientists any moral platform on which to hold forth on the proper moment when abortion can, or cannot, be constitutionally prohibited.

In the same way, the Court was in error in the recent case of *Kansas v. Hendricks*¹⁰⁵ when it ignored the entire issue of the reliability of predictions of violence as regards commitment of so-called sexual predators.¹⁰⁶ This is not to say that the outcome should have been different if the Court had considered and understood the research. Legal outcomes can be criticized only from the law's perspective. To be sure, the research available is part of the equation. But the research, no matter how good it is, never dictates legal results. Science simply cannot say what ought to be done with its findings.

In practical terms, then, as a science, psychology should be limited to criticizing the law for failure to use its findings well. It cannot prescribe to the law how to use its findings. This, in a somewhat roundabout way, returns me to the matter with which I opened, Justice Breyer's question: What is good psychology? Psychology is good when it is a science. It is a science to the extent that it limits itself to the empirical world, and it can be measured by how well it tests its hypotheses. The measure to be used for psychology must be the measure used for all sciences. Psychology should be evaluated by its success in explaining and predicting human behavior, just as meteorologists are measured by their success at explaining and predicting the weather.

Many who work in the area of psychology and law, of course, own two hats, being trained in both disciplines. But it is inappropriate to wear the two

104. See generally *Roe v. Wade*, 410 U.S. 113 (1973) (prohibiting state proscription of abortion prior to viability of fetus).

105. 521 U.S. 346 (1997).

106. See *Kansas v. Hendricks*, 521 U.S. 346, 357-59 (1997) (discussing predictions of future violence).

hats at the same time. Nonetheless, those who wear law hats should be heartily encouraged to consort with those who wear science hats. The two groups should get together and discuss and debate the intersection of these two great professions. These institutions have much to learn from one another. But at the end of the day, they each must go home to their respective houses. They work together, but they cannot live under the same roof, or by the same rules. I remember that one of my father's favorite sayings when I reached adolescence was: "If you live under my roof, you have to obey my rules." Well, that is true for law and psychology too. Science and the law are two wholly different institutions, with very different histories, different methodologies, different standards for success, and different objectives. In our world they are both indispensable, but not reconcilable. We should not wish them to be. In some ways, they are like the branches of the federal government, which were created, in part, to check the excesses and jealousies of one another. They share power, but they also check one another's power. In our world, the three great institutions are science, law, and religion. They should retain their separate identities, the better to accomplish their separate objectives, and the better to check the power of the other two. We should no more wish that science and law merge than we should wish that either science or law merge with religion.

III. *The Legal Academy*

Although Mariana Azuela was correct that thinkers prepare the revolution while bandits carry it out,¹⁰⁷ the legal academy has been at best uneven in its support for, and understanding of, this particular revolution. In fact, some of the best work on behalf of the revolution has come from the academy that serves the federal judiciary, the Federal Judicial Center. The Center was well ahead of the *Daubert* curve in publishing its *Reference Manual on Scientific Evidence* in 1994.¹⁰⁸ In contrast, the law school academy, although very enthusiastic, has shown a disappointing lack of imagination in response to the battles raging in the streets. The cause for this appears to be the same malady that infects the legal world more generally: little or no appreciation for the scientific method and scientific culture. Academics, however, have less of an excuse than other legal actors because they are in the business of education.

An adequate treatment of this subject would require an extensive study of the backgrounds of legal academics, the content of their scholarship, and the curriculums of the nearly two-hundred ABA accredited law schools in the

107. See *supra* note 3 and accompanying text.

108. REFERENCE MANUAL ON SCIENTIFIC EVIDENCE (1994).

United States. I can offer only a few passing observations about the state of the legal academy in regard to the ongoing scientific revolution. The subject, however, is well worth the attention of social scientists. My remarks here mainly concern the quality of the scholarship to date and the failure of the law schools to integrate more fully the scientific method into their curriculums.

On the positive side, legal scholars have done much to publicize and chronicle the changing times. The law reviews have been teeming with articles on the law and science connection,¹⁰⁹ and there have been more than a few symposia, such as the one that this Essay joins, on the subject.¹¹⁰ But much that has been written has not been well informed by the scientific method. Many law professors are science neophytes and their scholarship reflects their limited background in the subject.

Because *Daubert* was ostensibly an evidence case, evidence scholars were the first group to jump headlong into the fray. Some were loyalists, but many others welcomed the new regime. Most of this group, though overall a rigorously thoughtful and thorough bunch, had no special backgrounds in science. Unfortunately, there was little time to gain any such background, and a substantial portion of the early scholarship manifests a profound naivete about how science is done. There are, of course, many exceptions, and over time the scholarship seems to be improving. But too much of it is improving as a consequence of the Supreme Court's leading the way. Lower courts would benefit greatly from more intellectual leadership from the academy.

Without attacking any individual scholars, the best illustration of this phenomenon was legal scholars' reactions to the question whether *Daubert* applied to so-called non-scientific evidence. Many evidence scholars thought that it did not, based upon the belief that the *Daubert* test applied only to conventional science. By conventional, they meant experimental research. This approach had two fundamental flaws.

The most obvious flaw was that *Daubert* itself did not involve a conventional experimental science because the issue there concerned the admissibility of expert testimony based on epidemiology. Epidemiology is based on research designs that measure associations and in which no independent variables are actively manipulated. In fact, it was an odd argument to follow because the question whether *Daubert* applied to non-scientific evidence eventually came to the Court in *Kumho*, a case that involved engineering expertise. Epidemiology is hardly more conventionally scientific than engineering.¹¹¹ Arguably, engineering is the "harder" science.

109. See 1 FAIGMAN ET AL., *supra* note 34, § 1-3.0 n.2, at 11 (citing articles).

110. See generally Symposium, *Evidence After the Death of Frye*, 15 CARDOZO L. REV. 1745 (1994).

111. See *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 141 (1999) ("This case requires

The second flaw was one of a basic misunderstanding of the nature of science. The scientific method is not one method. Different sciences require different methods, depending on the nature, difficulty, and context of the hypotheses of interest. Frequently, the same question requires a potpourri of methods in order to approach an answer. For instance, *Daubert* concerned whether Bendectin causes birth defects.¹¹² Obviously, no one proposes experimentally testing this hypothesis on humans. It must be studied using a variety of methods, ranging from clinical observation to animal studies to epidemiology. Researchers must assess all of this evidence together in order to decide whether Bendectin causes birth defects. The same is true for many of the applied sciences that the law must deal with on a daily basis.

Ironically, one of the sciences that has received little legal scrutiny by courts, lawyers, and academics is also one of the few areas that lends itself to rigorous experimental test: the forensic sciences. Much more than psychology and medicine, forensic sciences such as fingerprinting, firearms identification, handwriting identification, bite marks, tool marks, and so on, lend themselves to extensive laboratory evaluation. Why the law has not yet insisted that these tests be done appears to be more a function of politics than anything having to do with the difficulty of doing the science.

If those who specifically write in the area of science and law demonstrate some lack of familiarity with the subject, those who teach and write in other areas seem to have even less appreciation for the changes occurring in the field. I must admit, however, that this impression is only that and is not informed by empirical research. Still, in informal discussions with colleagues at my school and others, as well as in conversations with my students, it appears that the core legal curriculum has yet to integrate the realities of scientific evidence. Given the amount of expertise that an attorney is likely to confront in a lifetime of practice, it should be something of a scandal that core courses hardly touch on it. For instance, criminal law classes should delve deeply into the forensic sciences. Torts classes should consider the sciences of toxicology and epidemiology behind toxic torts and the myriad engineers that litigants introduce in product liability cases. Even if it is somewhat unrealistic to expect these introductory courses to spend substantial time on scientific topics, law schools should offer a wide menu of science and law courses for students to take after their first year of study.

If the law is ever to fully incorporate science into its decision making, law schools will need to provide the basic training. Law schools are in the

us to decide how *Daubert* applies to testimony of engineers and other experts who are not scientists.").

112. See *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 582 (1993) (stating facts of case).

business of teaching critical thinking, or what we fancifully call thinking like a lawyer. Now, at the beginning of the twenty-first century, it is no longer possible to be a critical thinking generalist if you cannot think critically about science.

IV. Conclusion

Despite the seeming pessimism that runs throughout this Essay, I should say that I am basically optimistic about the future of the law and science connection. Finally, with the *Daubert* trilogy, and other developments, the law has joined the scientific revolution. Over the next twenty years or so, lawyers and judges will become increasingly sophisticated consumers of science. While the old-order continues to resist, the triumph of the new regime is only a matter of time. These reforms originally were prompted by events prior to *Daubert*, as the courts increasingly were deluged with toxic torts, DNA profiling, and psychological syndromes. In the future, the human genome project, intellectual property issues, forensic science, and, undoubtedly, more psychological syndromes will push the courts to greater levels of scientific sophistication. Judges who learn multiple regression analysis in order to assess epidemiological research will have that knowledge when they confront the next psychological disorder. An understanding of base-rates in DNA profiling should translate into knowledge of base-rates in psychological predictions. All of this means that psychology will confront increasingly vigilant gatekeepers. Scientists should welcome this vigilance. Someday, *Daubert* will be understood not only as a wake-up call to the law. It also will be seen as a wake-up call to the sciences and specialties who seek to influence the law. Whether it is toxicologists who serve plaintiff's attorneys, forensic scientists who serve prosecutors, or psychologists with their own political agendas, these sciences will be forced to improve their methods or seek employment elsewhere. We already have begun to see this with the forensic sciences, as the FBI scrambles to begin validating such old-standards as ballistics, toolmarks, handwriting, and even fingerprinting. Clinical medicine is likely to be next. The day of reckoning for psychology is near. The *Daubert* trilogy thus signifies the opening canon-fire of the scientific revolution in law. Alchemists, philosophers, moralists, theologians, and hired guns are the fitting victims of this revolution. As Yeats wrote: "Hurrah for revolution."¹¹³

113. WILLIAM BUTLER YEATS, *The Great Day*, in *LAST POEMS & PLAYS* (1940).